EASY-OPENING CONTAINER AND PLASTIC CLOSURE THEREOF FOR HERMETIC SEALING

BACKGROUND OF THE INVENTION

1) Field of the Invention

This invention relates to a plastic, easy-opening closure for hermetic sealing of an open end of a retortable container and an easy-opening container that is hermetically sealed by such a closure.

2) Description of Related Art

A variety of closures are known for the hermetic sealing of a container, such as conventional tin-plated steel cans that are widely used for containing food products. Retortable containers are those that can withstand a pasteurization or retort process comprising heat and pressure for preserving the food contents of the container. During retort, the container can be subjected to temperatures above 212° F and up to 250° F under pressures of 15 to 30 psi.

Easy-opening containers are those that can be opened without undue effort and without the use of a special tool such as a rotary can opener. In order for an easy-opening container to be retortable, the closure must be sufficiently strong to resist stresses that develop as a result of the retort heat and pressure but easily overcome during opening. One conventional easy-opening, retortable container includes a closure that is stronger in shear than tension. The closure is strong enough to withstand the shear force that develops during retort, while a relatively small tensile force is required to open the container. For example, U.S. Patent No. 5,752,614, titled "Easy-Opening Closure for Hermetic Sealing a Retortable Container," to Nelson describes an easy-opening closure that includes a metal end ring that can be seamed to an open end of a retortable container and defines a central opening that is covered by a membrane patch. The membrane patch is bonded to the end ring such that the bond is unaffected during retort processing but has a predetermined tensile force strength that is preferably less than 5 psi to allow peeling of the membrane patch from the end ring. Thus, the container can be retorted and subsequently easily opened.

Other easy open containers are formed partially or wholly of plastic. For example, a lid that includes a metallic foil can be adhered to a plastic container, which can be used for retort. The adhesive used to bond the foil to the container is strong enough to withstand retort but can be easily overcome when a consumer peels the foil from the container. Attempts have also been made to manufacture retortable containers exclusively of plastic. For example, a plastic membrane can be heat sealed to a plastic container. Alternatively, the plastic membrane can be heat sealed to a plastic end ring that is similar to the metal end ring described by Nelson, and the plastic end ring can be fusion bonded to the container by spin welding. A pull ring or tab can also be provided on the plastic membrane so that a user can grasp the membrane to it from the container, thereby breaking the bond between the plastic membrane and the container or plastic end ring. Such bonds can be difficult to form by heat sealing due to the poor thermal conductivity of the plastic. Further, if the strength of the bond is not controlled precisely, the bond may be insufficiently strong to resist the stresses that are applied during retort or too strong for a user to overcome in order to open the container.

Thus, there exists a need for a plastic, easy-opening closure for hermetically sealing an open end of a retortable container and an easy-opening container that is hermetically sealed by such a closure. The closure should be strong enough to withstand the stresses induced during retort, but easily removed by a user.

BRIEF SUMMARY OF THE INVENTION

The present invention provides a plastic, easy-opening, retortable container for hermetic sealing and a closure for such a container.

According to one embodiment, the container has a bottom and side and defines an interior space and an opening thereto. The plastic membrane is joined to the base portion to cover the opening. An annular groove is disposed on a first side of the membrane and defines inner and outer coplanar portions thereof. A grip portion, such as a pull ring, is integrally connected to a second side of the membrane at the inner portion. The annular groove defines an annular fail portion between the inner and outer portions of the plastic membrane such that the inner portion can be removed from the outer portion by urging the grip portion away from the outer portion, thereby tearing the annular fail portion and opening the container.

The base portion can also be formed of plastic, and both the membrane and base portion can be formed of a high barrier material that prevents transmission of moisture and oxygen. For example, the membrane can be formed of polyolefin and can include oxygen scavengers disposed therein. The membrane can define a circumferential ridge extending from the first side for engaging the base portion of the container, for example, by a friction weld joint.

The grip portion can be connected to the inner portion of the plastic membrane by a primary connection portion and at least one secondary connection portion. The primary connection portions are weaker than the primary connection portion and configured to break when the grip portion is urged from the inner portion. Thus, the grip portion can be rotated, hinged by the primary connection portion, and then further pulled to open the container. Further, the fail portion can have a strength of about 14 pounds or less.

Thus, the present invention provides a plastic closure that can be used to hermetically seal a container. The closure and the container are retortable, and a fail portion on the membrane of the closure allows the container to be easily opened by a user.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Having thus described the invention in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

Figure 1 is a perspective view of an easy-opening, retortable container according to one embodiment of the present invention;

Figure 2 is a plan view illustrating the container of Figurer 1;

Figure 3 is a partial sectional view in elevation of the container of Figure 1, as seen along line 3-3 of Figure 2;

Figure 4 is a partial sectional view in elevation of the container, as seen along line 4-4 of Figure 2;

Figure 5A is a perspective view of the container of Figure 1, illustrating the operation of the pull ring, with the pull ring shown in both rotated and unrotated positions; and

Figure 5B is a partial perspective view of the container of Figure 1, illustrating the removal of the closure.

DETAILED DESCRIPTION OF THE INVENTION

The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all embodiments of the invention are shown. Indeed, the invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like numbers refer to like elements throughout.

Referring now to Figures 1 and 2, there is shown an easy-opening container **10** according to one embodiment of the present invention. The container **10** has a base portion **12**, which defines an openable first end **16** that is closed by a closure **30**. The base portion **12** can be formed of a variety of materials, such as metals, including steel, aluminum, and tin, as well as plastic, cardboard, and laminates of multiple materials. In the illustrated embodiment, the base portion **12** includes a continuous cylindrical side **14** that extends longitudinally from the openable first end **16** to a second end **18**, which is closed by a bottom **20**. Preferably, at least the openable first end **16** of the base portion **12** has a circular cross section so that the closure **30** can be friction welded thereto. The side **14** can also comprise alternative configurations, for example, multiple rectangular panels configured at right angles so that part or all of the base portion **12** has a square cross section instead of circular as shown. The bottom **20** can be formed separately from the side **14** and joined thereto, for example, by crimping, welding, gluing, and the like. Alternatively, the side **14** and the bottom **20** can be formed as a unitary member, for example, by injection molding or blow molding the side **14** and bottom **20** of plastic. Additionally, the side **14** can have a tapered shape, such as a conical shape, that includes the bottom **20**.

The openable first end **16** is closed by the closure **30** such that the base portion **12** and the closure **30** define an interior space **22** therein, which can be hermetically sealed. As shown in Figure 1, the closure **30** can be connected to the side **14** of the base portion **12**. Alternatively, however, the base portion **12** can also include an end ring that extends radially inward from the side **12** to define an opening that is smaller than the diameter of the side **14** at the first end **16**. Such end rings are known in the art, as are various methods of connecting the end ring to the base portion, such as by forming a double seam around the circumference of the openable end **16**.

As shown in Figure 3, the closure **30** includes a membrane **32** that covers the openable end **16**. The membrane has first and second opposing sides **34, 36**, the first side being directed toward the interior space **22** of the container **10**. A groove **40** or score extends annularly on the membrane **32** and defines a fail portion **42**. For example, as shown in Figure 3, the groove **40** is disposed on the first side **34** of the membrane **32**, and the groove **40** therefore defines the fail portion **42** between the groove **40** and the second side **36** of the membrane **32**. In other embodiments, the groove **40** can be disposed on the second side **36** of the membrane **32** so that the fail portion **42** is defined between the groove **40** and the first side **34**. The groove **40** can define a circular shape or other shapes including a rectangle, ellipse, and the like.

The groove **40** defines an inner membrane portion **44** radially within the groove **40** and an outer membrane **46** portion radially outside the groove **40**. The inner and outer membrane portions **44, 46** are preferably coplanar. By coplanar, it is meant that at least the adjoining edges of the inner and outer membrane portions **44, 46** are coplanar, i.e., the outermost portion of the inner membrane portion **44** is coplanar with the innermost portion of the outer membrane portion **46**. Thus, the entire inner and outer membrane portions **44, 46** can lie in a single plane, as shown in Figures 1-3, or one or both of the membrane portions **44, 46** can define nonplanar contours. Flanges **47** can be provided on one or both of the membrane portions **44, 46** to stiffen or otherwise provide support to the membrane portions **44, 46**.

The closure **30** also includes a grip portion such as a pull ring **50** that is disposed on the second side **36** of the membrane **32**, i.e., opposite the groove **40**, as shown in Figure 3. Alternatively, the grip portion can be a tab or other feature that can be grasped or otherwise manipulated by a user to open the container **10**. The pull ring **50** is attached to the inner membrane portion **44** by a primary connection **52** so that the user can peel the inner membrane portion **44** from the container **10** by pulling on the ring **50**. Further, one or more secondary connections **54** can be provided between the pull ring **50** and either of the membrane portions **44, 46** or another part of the container **10**. The secondary connections **54** are preferably weaker than the primary connection **52** so that the user can first break the secondary connections **54**, then pull the ring **50** away from the container **10**, thereby pulling the inner membrane portion **44** via the primary connection **52**.

For example, the user can grasp the pull ring **50** at a location near or between the secondary connections **54** and urge the pull ring **50** away from the container **10** to

thereby break the secondary connections **54** and rotate the pull ring **50** about the primary connection **52**, as shown in Figures 4 and 5A. Thus, the pull ring **50** rotates or hinges about the primary connection **52** so that further urging on the pull ring **50** begins to tear the fail portion **42** at a location near the primary connection **52**, as shown in Figure 5B. Portions **54a** of the broken secondary connections **54** can remain connected to the pull ring **50**. The user can then continue to tear the fail portion **42** circumferentially in both directions from the primary connection portion **52** until the container **10** is sufficiently opened and/or the inner membrane portion **44** is completely removed from the closure **30**. The outer membrane portion **46** remains in place when the inner membrane portion **44** is removed so the outer membrane portion **46** defines an opening **48** to the interior space **22** of the container **10**.

Preferably, the closure **30** provides a hermetic seal to the container **10** such that the container **10** can be used for storing food items and other items requiring a hermetic seal or a reduced or enhanced storage pressure. The closure **30**, including the fail portion **42**, is sufficiently strong to withstand the retort process, in which the sealed container **10** is subjected to relatively high temperatures and corresponding internal pressure; however, a person can easily open the container **10** by pulling on the pull ring **50** and tearing the fail portion **42**. For example, the closure **30**, including the fail portion **42**, can have a shear force strength of at least about 20 psi, and the fail portion **42** can have a tensile force strength that is less than about 14 pounds. Thus, the fail portion **42** can withstand the stresses applied during retort, but tears when put in tension by the user.

The closure **30** is preferably formed as an integral member, for example, by injection or blow molding the closure **30** of plastic. The closure **30** can be formed with a mold that defines the inner and outer membrane portions **44**, **46**, the groove **40**, the pull ring **50**, and the connections **52**, **54**. If the closure **30** is molded, the groove **40** can be formed during the same molding process. Alternatively, the groove **40** can be formed by cutting, grinding, or otherwise removing material from the membrane **40**. Various types of plastic can be used, and a high barrier material can be used where desired to prevent the transmission of moisture, oxygen, or other fluids, such as where the container **10** is used in food packaging. For example, the closure **30** can be formed of a polyolefin such as polypropylene. Further, chemical compounds that absorb oxygen, referred to generally as oxygen scavengers, can be disposed in the

polyolefin to prevent the transmission of oxygen through the lid. For example, a moisture-activated, iron oxide-based oxygen scavenger can be used.

The closure **30** can also define a feature for connecting the closure **30** to the side **14** of the container **10**. For example, as shown in Figure 3, a circular ridge **60** can be provided at an outer periphery of the outer membrane portion **46**, the ridge **60** corresponding in diameter to the side **14** so that the ridge **60** can be connected thereto. The outer diameter of the ridge **60** can correspond to an inner diameter of the side **14** so that the ridge **60** can be inserted into the container **10**. Alternatively, the inner diameter of the ridge **60** can correspond to the outer diameter of the side **14** so that the ridge **60** receives the side **14** therein.

The closure **30** and the base portion **12** can be joined by gluing or adhering, press fitting, welding, or other methods. For example, the closure **30** can be spin welded to the side **14** by rotating the closure **30** relative to the base portion **12** and pressing the outer membrane portion **46** against the side **14** such that frictional heat is generated therebetween. A portion of the closure **30** and/or the base portion **12** are thereby plasticized, and as the plasticized region mixes and cools, a friction bond is formed, joining the closure **30** to the base portion **12**.

Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the inventions are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.